USING CONTESTS TO SOLVE HIGHLY COMPLEX DATA & ANALYTICS PROBLEMS

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The Laboratory for Innovation Science at Harvard (LISH) is spurring the development of the **science of innovation** through a systematic program of solving real-world innovation challenges while simultaneously conducting rigorous field-based social science research.

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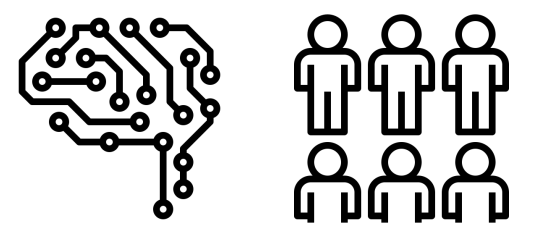
CAN THE CROWD BEAT HARVARD MEDICAL SCHOOL?

- **Objective**: Make the NIH MegaBlast algorithm for nucleotide sequence alignment for genomics be faster and more accurate

- **Why Important?** Genomic sequencing is now a key tool in like sciences and medical research — a data explosion that is creating *research and clinical bottlenecks*

- **Approach**: Design a two week long contest with $6000 prize pot on Topcoder platform

HARVARD
MEDICAL SCHOOL

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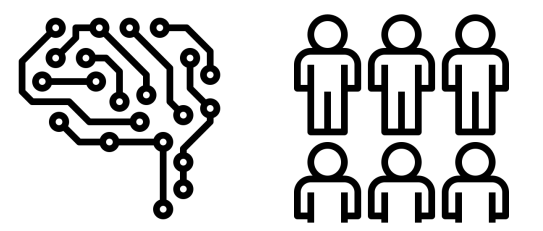
WHAT HAPPENED?

- **89 different approaches** to solve problem identified

- 122 coders submitted 654 submissions

- Winners from Russia, France, Egypt, Belgium & US

- **Annotate 10 million sequences in < 3 mins**; Quarter billion sequences ~1 hour on laptop
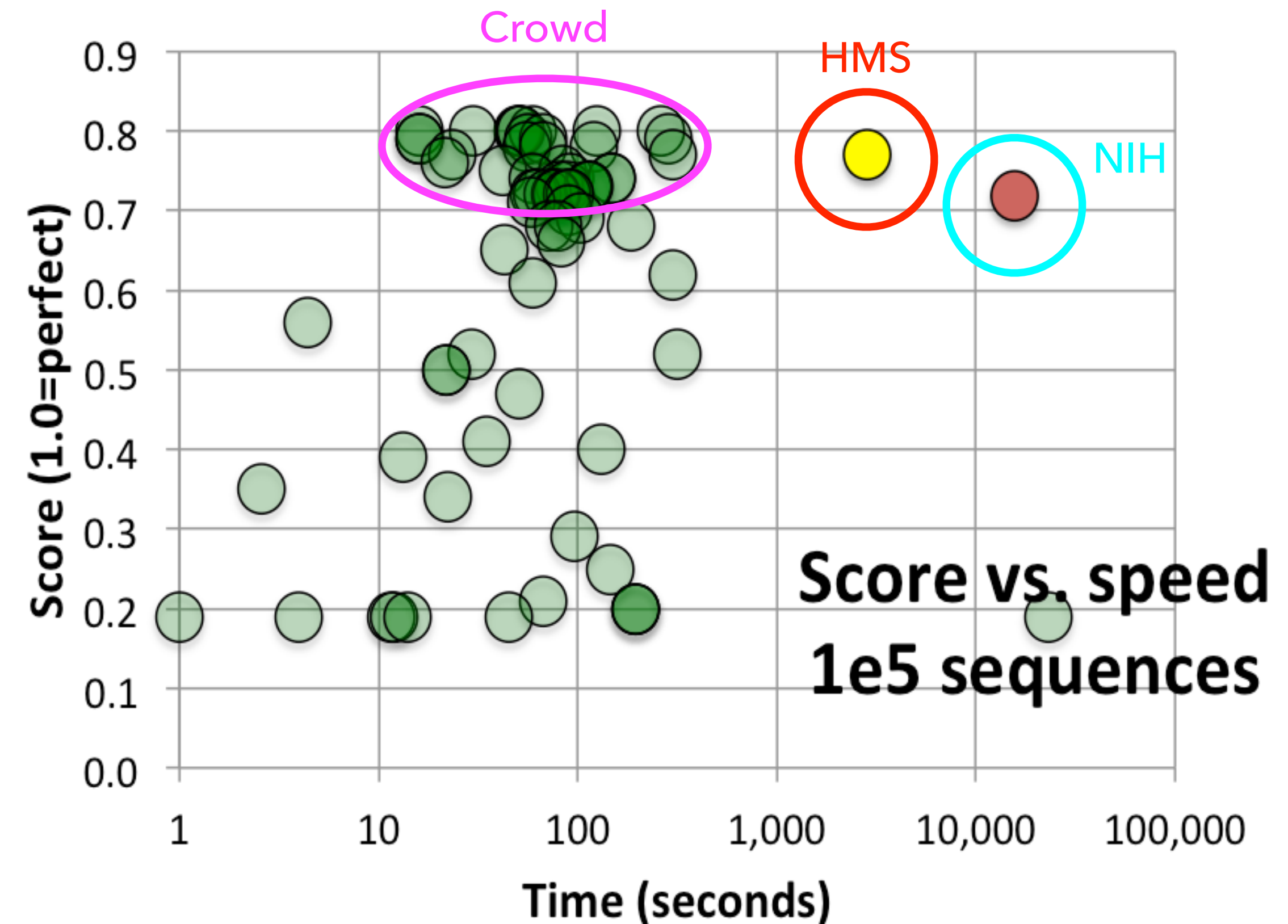
Lakhani, K. R., Boudreau, K. J., Loh, P.-R., Backstrom, L., Baldwin, C., Lonstein, E., … Guinan, E. C. (2013). Prize-Based Contests Can Provide Solutions to Computational Biology Problems. *Nature Biotechnology*, *31*(2), 108–111. http://doi.org/10.1038/nbt.2495
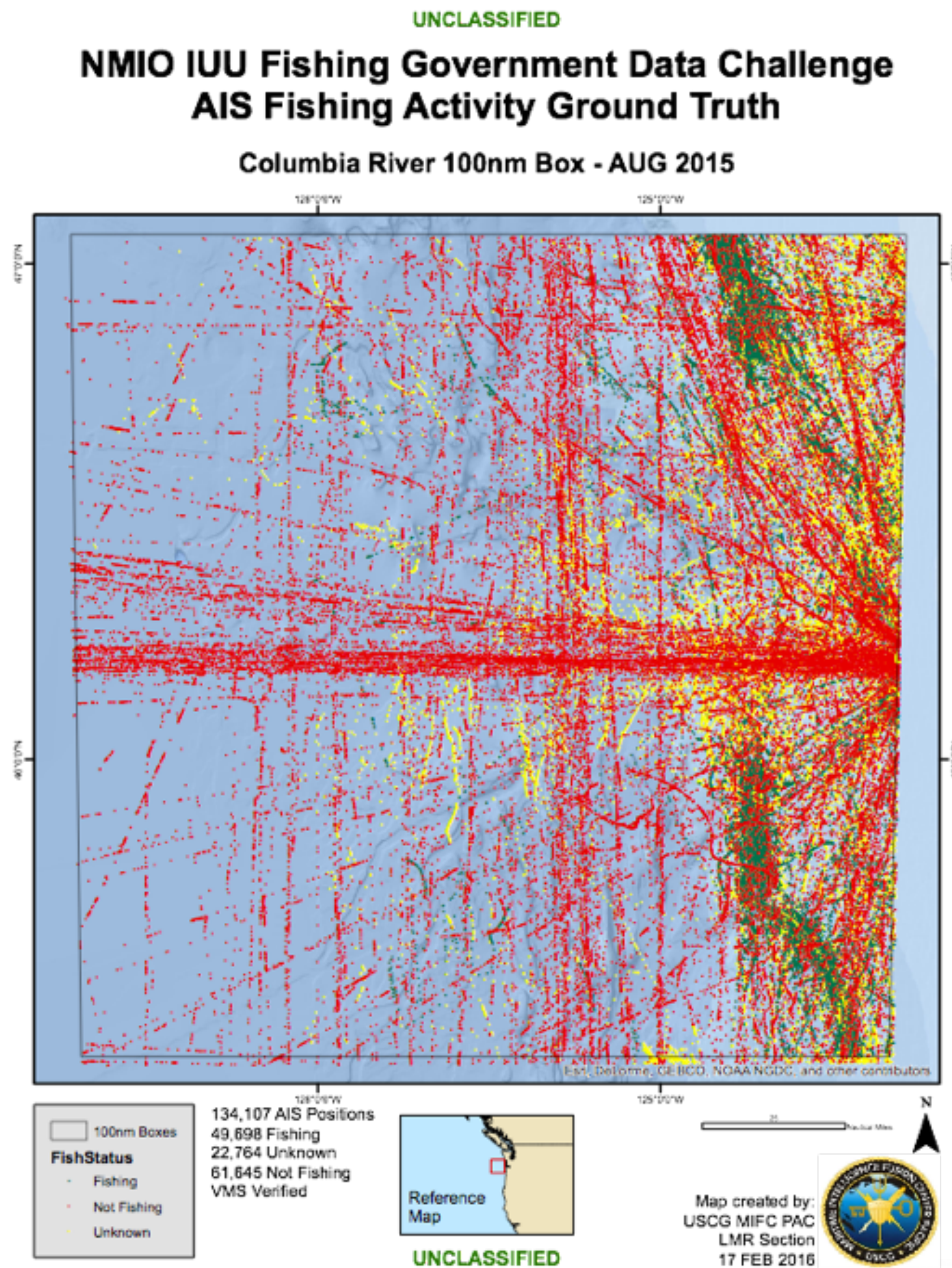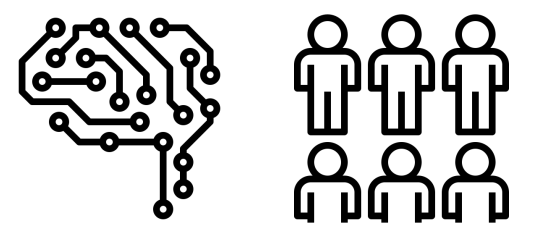
WHAT ABOUT OTHER TYPES OF PROBLEMS?

NMIO IUU Fishing Government Data Challenge
AIS Fishing Activity Ground Truth
Columbia River 100nm Box - AUG 2015

- **Background:** Individuals engage in illegal, unreported, and unregulated fishing that circumvent conservation and management measures, avoiding costs associated with sustainable fishing practices, and derive economic benefits from exceeding harvesting limits

- **Goal for Contest 1:** Use existing data sets to develop a predictive algorithm to effectively identify if a vessel is fishing, based on observable behavior regardless of vessel type or declared purpose

- **Goal for Contest 2:** Use existing data sets to develop a predictive algorithm to effectively identify if a vessel is fishing, and what type of fishing they are doing

FISHING FOR FISHERMAN CONTEST OUTCOMES
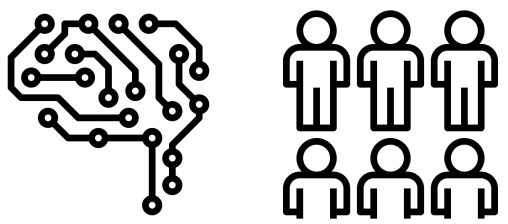
Contest 1 Details

📅 14 Days

🏆 $18K Prize pool
+ $1750 for supporting
contests & tasks

👥 489 Registered from 62 countries
77 Competitors from 26 countries

🌐 Winners from Poland, Brazil,
Austria, Japan & Romania

🧩 1206 Submissions,
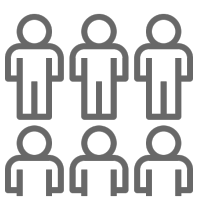298 uses of example tests

Contest 2 Details

📅 16 Days

🏆 $26K Prize pool

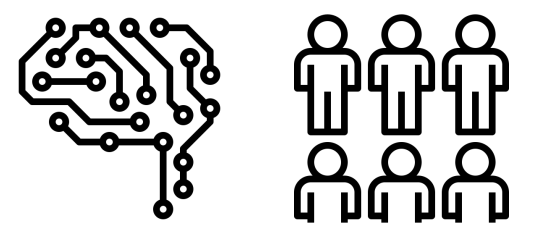👥 131 Registered from 31 countries
56 Competitors from 21 countries

🌐 Winners from Brazil, Poland,
Slovakia & Russia

🧩 807 Submissions,
152 uses of example tests

topcoder | NTL NASA Tournament Lab | ISE. | LISH Laboratory for Innovation Science at Harvard

Two algorithms were developed and are being tested in the Naval Research Lab

- Contest 1 Algorithm can distinguish fishing from not fishing with 97% predictive power

- Contest 2 Algorithm can distinguish type of fishing activity with 91-98% predictive power depending on class of vessel

The project has been nominated for 2017 SECNAV Innovation Award

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2017 SECRETARY OF THE NAVY'S INNOVATION AWARDS PROGRAM

Award Categories

- ❖ Innovation Leadership
- ❖ Innovation Catalyst
- ❖ Data Analytics
- ❖ Technology Development
- ❖ Automated Process Development

- ❖ Innovation Scholar (PME)
- ❖ Innovation Scholar (MIDN)
- ❖ Enlisted Innovator
- ❖ Outside the Box

Trophy Design Contest

In support of the Innovation Awards above, the trophy design contest allows creative Sailors, Marines, and DON Civilians the ability to showcase their talents to recognize the Innovation Award Winners.

The eligibility period is from 1 Jan to 31 Dec 2017

Additional information can be found at: www.secnav.navy.mil/innovation

The deadline for submissions is 31 Jan 2018

Across the Department of the Navy (DON) our talented Sailors, Marines and Civilians are continually creating innovative solutions to our most complex problems. The Annual SECNAV Innovation Awards Program acknowledges top Naval Innovators in our workforce today and inspires the problem solvers of the future. The awards program recognizes top DON individuals or teams making significant problem solving contributions in 2017 in the following areas:

- **Innovation Leadership**: Recognizes top naval leaders who inspire innovation within their organization or team. This can be done

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ISS Food Intake Tracker

Robonaut 2

Challenge - Create an iPad application for ISS crewmembers to easily enter their dietary intake

Challenge Budget $144,600

Challenge Award $36,288

More Detailed Food Log

Results
- Will provide NASA scientists a better understanding of nutrition to help mitigate negative physiological effects of spaceflight
- Final updates in work for upload to ISS December 2015

Topcoder Marathon Match
NASA's Robonaut Vision Tool Manipulation

$10,000 in Total Prizes
Challenge Go-Live 2/23 1PM ET

Pre-Register for the challenge:
www.crowdsourcing.topcoder.com/robo_mm
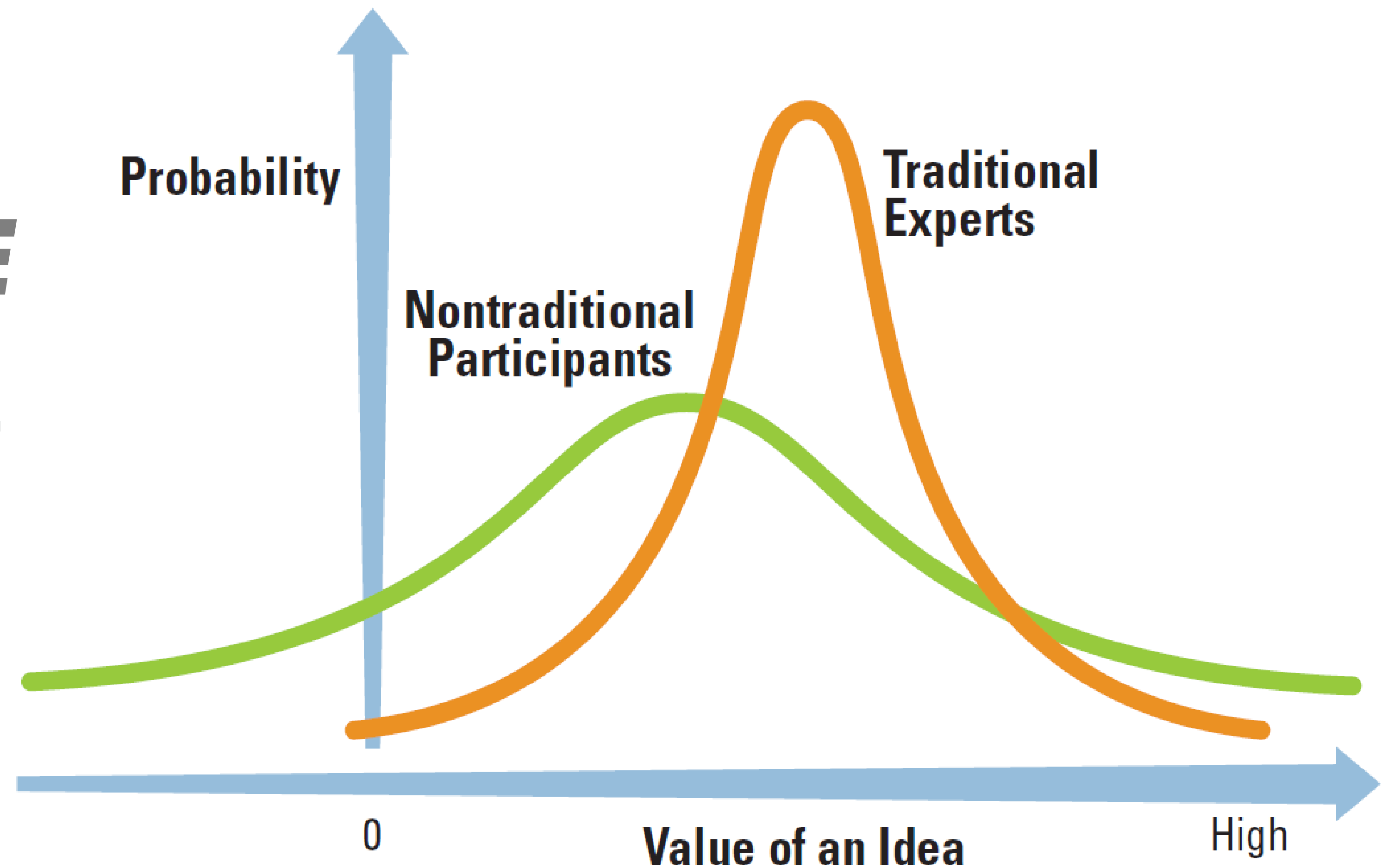
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Better

Faster

Cheaper

WHAT HAVE
WE FOUND?

QUESTION REMAINS: WHEN DO YOU GO TO THE CROWD?

Can the problem be defined for external solver?

Do you have an in-house expert who can implement the solution?

Can the data & tools be made accessible to solvers?

Questions to ask before going to the crowd

Do you have budget, staff & time to allocate to this project?

Can the outcome be objectively evaluated?

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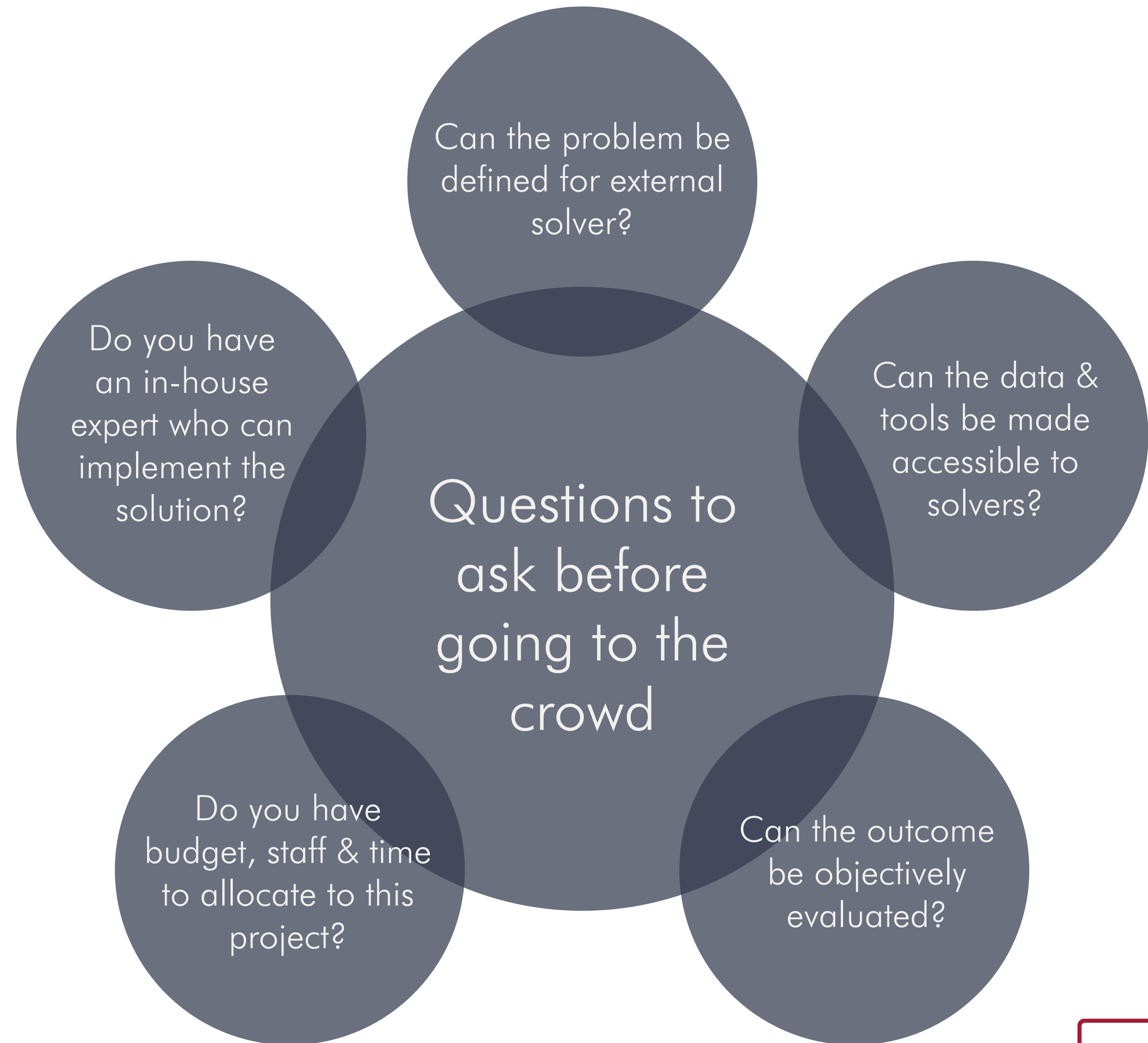
	Question	Resource	Scope
Make	Poorly Defined	Internally Available	Broad or Unknown
Buy	Standard	Known and Available	Devoted Timeline
Innovate	Well Defined	Unknown or Unavailable	Focused Effort

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WHAT MAKES A GOOD CHALLENGE?

- Well-formulated question

- Easily identifiable ground truth and benchmarking

- Implementation and execution plan prior to challenge launch

- Type of solver matches problem in scale and scope

  - Pick the crowd and the platform that best matches your solver needs
    - e.g., optimization problem needs someone with background in coding

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QUESTIONS?

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